

Arrhenatherum elatius subsp. *bulbosum* (Poaceae): A New Alien Record for the Flora of Turkey

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ABSTRACT

Invasive alien species are one of the largest threats to global biodiversity together with social, environmental and economic problems. As well, they present significant threats to global agriculture especially in the regions with moderate temperature as in northeast Anatolia. *Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl. & C. Presl. subsp. *bulbosum* (Willd.) Schübl. & Martens (Poaceae) was observed in farmlands, an invasive alien taxon in tea and hazelnut plantations, in Turkey where it was established in a new ecosystem, outside its natural range in SW Europe. In this article, this subspecies was reported as a new alien vascular plant taxon for the Flora of Turkey. At the base of its stems the adjacent nodes are swollen and form a chain of bulbs which characterize this taxon and differentiate it from other subspecies. New Turkish name and photographs of the new record are also presented in the article.

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ÖZET

İstilacı yabancı türler, sosyal, çevresel ve ekonomik sorunlarla birlikte küresel biyolojik çeşitliliğe karşı en büyük tehditlerden biridir. Ayrıca, özellikle kuzeydoğu Anadolu—gibi ılıman iklime sahip bölgelerde küresel tarıma yönelik önemli tehditler sunmaktadır. *Arrhenatherum elatius* (L.) P. Beauv. ör. J. Presl. & C. Presl. subsp. *bulbosum* (Willd.) Schübl. & Martens (Poaceae), güneybatı Avrupa'daki doğal yayılışı dışında, Türkiye'deki yeni bir ekosistemde, çay ve fındık bahçelerinde gözlemlendi. Bu makalede, bu alttür Türkiye Florası için yeni bir yabancı vasküler bitki taksonu olarak rapor edilmektedir. Gövdelerinin tabanında bitişik nodlar şişerek bu taksonu karakterize eden ve diğer alt türlerden ayrılan bir yumru zinciri oluşturur. Makalede yeni Türkçe adı ve yeni kaydın fotoğrafları da sunulmaktadır.

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INTRODUCTION

Plant invasions have negative impacts across several sectors such as agriculture, tourism, forestry, fishery, human health, water, and irrigation (Kariyawasam, 2019). The invasive alien species (IAS) are recognized as a serious threat to the environment, economy, and social well-being of the world (McNeely et al., 2001; Lamke and Brown, 2012) and pose a serious threat to biodiversity and natural resources (McDougall et al., 2018). They are a major cause of crop loss and can adversely affect food security (Cook et al., 2011). The majority of these plants have been planted for different purposes and some of them has been unexpectedly

introduced out of their natural habitats. As it depends on human activities, it is difficult and complex to explain the real factors of this naturalization process. It is not difficult to say that many of IAS have hitherto been easily colonized and naturalized in NE Anatolia where climatic conditions are favorable. In cases these species reach suitable habitats in this part of Turkey, with different ways, they may germinate and give rise to new populations (Terzioğlu and Anşin, 2001). Some large plant families such as Poaceae (Uchida et al., 2017) and Asteraceae (Witt et al., 2019) have many alien invasive taxa distributed different terrestrial ecosystems of the world.

Depending on worldwide phylogenetic classification, the family Poaceae, with about 11506 species and 768 grass genera (Perreta et al., 2009; Soreng et al., 2017), ranks as the second largest monocot family and the fifth largest plant family (Cabi et al., 2017; Perreta et al., 2009). As well, grasses are reported to cover 20% of the earth's land surface (Eckardt, 2008). Poaceae of Turkey was reported to host 146 grass genera including 547 species and 658 taxa (Cabi and Doğan, 2012), after which new grass taxa were recorded or added to Turkish flora (Cabi et al., 2017). From plant migration point of view, with the total number of alien (30 ones, excluding the present record) and naturalized (22 ones) taxa, Poaceae has been reported as the second largest family in Turkey after than Asteraceae (Uludağ et al., 2017).

The genus *Arrhenatherum* P. Beauv. is represented by three taxa in Flora of Turkey such as *A. elatius* (L.) P. Beauv. ex J.Presl & C.Presl subsp. *elatius*, *A. kotschyi* Boiss. and *A. palaestinum* Boiss. (Doğan, 1985; Cabi and Doğan, 2012). In the world, *A. elatius* has been categorized into four 'subspecies' such as subsp. *elatius*, subsp. *bulbosum* (Willd.) Schübl. & G.Martens, subsp. *sardoum* (Em. Schmid) Gamisans and subsp. *baeticum* Romero Zarco (Romero-Zarco, 1985; Miller et al., 1996; Cueto et al., 2018). Subsp. *bulbosum* (bulbous oat grass) is reported that it was cultivated for its moniliform tubers during the Bronze Age (Poindexter, 2011).

A. elatius subsp. *elatius* was the only Turkish taxon of the species (Doğan, 1985; Cabi and Doğan, 2012). In the present study, *A. elatius* subsp. *bulbosum* is recorded as a new alien taxon for the flora of Turkey from Rize province. This taxon is widely distributed in different countries as cultivated (Wu et al., 2006) or alien vascular plant taxon (Pfitzenmeyer, 1962; Tanhiphat, 1990; Poindexter, 2011) and has never been reported from Turkey before.

MATERIAL and METHOD

Voucher specimens were deposited in KATO Herbarium (in Karadeniz Technical University, Faculty of Forestry) in Trabzon. Materials were collected from a dense population in tea and hazelnut plantations and coordinated by GPS (UTM 50 Datum). Population has been monitored by the local people (Mehmet Çolakoğlu and his brother) for five years, and they have been tried to eradicate it.

After examination of the materials and checking with proper literature (Ayres, 1977; Holub, 1980; Doğan, 1985; Khan, 1991; Cabi and Doğan, 2012; Uludağ et al., 2017; Wu et al., 2006), it was determined as a new alien record for the flora of Turkey.

RESULTS and DISCUSSION

Arrhenatherum elatius (L.) P. Beauv. ex J. Presl. & C.

Presl. subsp. *bulbosum* (Willd.) Schübl. & Martens, Fl. Vürtemberg 70 (1834) : **Yumrulu Çayırçulafi**

Syn.: *Arrhenatherum avenaceum* var. *bulbosum* (Willd.) Hartm., *Arrhenatherum bulbosum* (Willd.) C.Presl., *Arrhenatherum bulbosum* var. *variegatum* Hitchc., *Arrhenatherum bulbosum* f. *bulbosum* (Willd.) T.Koyama, *Arrhenatherum bulbosum* var. *bulbosum* (Willd.) Spann., *Arrhenatherum elatius* f. *striatum* F.T. Hubb., *Avena bulbosa* Willd., *Avena elatior* subsp. *bulbosa* (Willd.) Litard., *Avena bulbosus* (Willd.) Schrad. (TPL, 2020).

Location: A8 Rize - Fındıklı, in tea and hazelnut plantations, 35 m, 29.05.2019, UTM: 0680491, 4569884, KATO 23230! (Figure 1).

In order to eradicate the individuals of the taxon from the gardens, owner called me to learn the control methods of this weed. After the careful examination, I identified that the specimens belong to *A. elatius*. In the Flora of Turkey, this species is represented with the subsp. *elatius* (Doğan, 1985; Cabi and Doğan, 2012) which have no basal bulbs. This newly recorded subspecies invests large amounts of reserves in the basal bulbs and developed highly specialized perennating organs which act as vegetative propagules (Khan, 1991). This SW European taxon is reported that the stem with (1-) 2-6 (-8) swollen, globose basal internodes 6-10 mm in diameter (Brullo et al., 1997; Holub, 1980; Wu et al., 2006). However, I counted the number of swollen internodes up to 16 (figure 1/g, h), and measured bulbs up to 15.78 mm in diameter (figure 1/i).

Key to subspecies of *A. elatius* distributed in Turkey:

1. Basal internodes of culm not swollen into globose corms, nodes usually glabrous..... subsp. *elatius*
1. Basal internodes of culm swollen into globose corms, nodes often hairy subsp. *bulbosum*

A. elatius subsp. *bulbosum* is a new record for the Flora of Turkey and collected from A8 Rize Province, Fındıklı district together with the native and naturalized taxa listed below:

Artemisia verlotiorum Lamotte, *Calystegia silvatica* (Kit.) Griseb., *Camellia sinensis* (L.) Kuntze var. *sinensis*, *Commelina communis* L., *Daucus carota* L., *Galium aparine* L., *Lolium perenne* L., *Lysimachia japonica* Thunb., *Oxalis articulata* Savigny, *Plantago major* L., *Polygonum thunbergii* Siebold. & Zucc., *Pteridium aquilinum* (L.) Kuhn, *Sonchus asper* (L.) Hill., *Tradescantia fluminensis* Vell., *Trifolium pretense* L., *Trifolium repens* L. together with many of the cultivated ornamental plants.

While it not known how this taxon got introduced to Rize province, it could have probably been disseminated by pot soil of ornamental plants which are commonly used in landscape design in close environs. The present distribution of this taxon in

Turkey indicated that it could be troublesome locally, but not nationally. However, this perennial grass may become an increasingly serious weed problem in farmlands. The lowest stem internodes of this plant swell and form corms which are readily separated by tillage, and each corm is capable of producing a new plant (Tanphiphat, 1990). On the other hand, it is reported that this taxon is eager to moderate temperature (Pfitzenmeyer, 1962) which is well

defined the climatic conditions of NE Anatolia. The soil conditions have no fundamental effect but merely modify the degree of corm development (Tanphiphat, 1990). Furthermore, Yazlık et al. (2018) underlined that within the total pool of alien species in Turkey, 23% occur in agricultural areas, amongst them 16% as naturalized and 7% as casual. So, the presence of this taxon in tea and hazelnut plantations in NE Anatolia is not surprising.

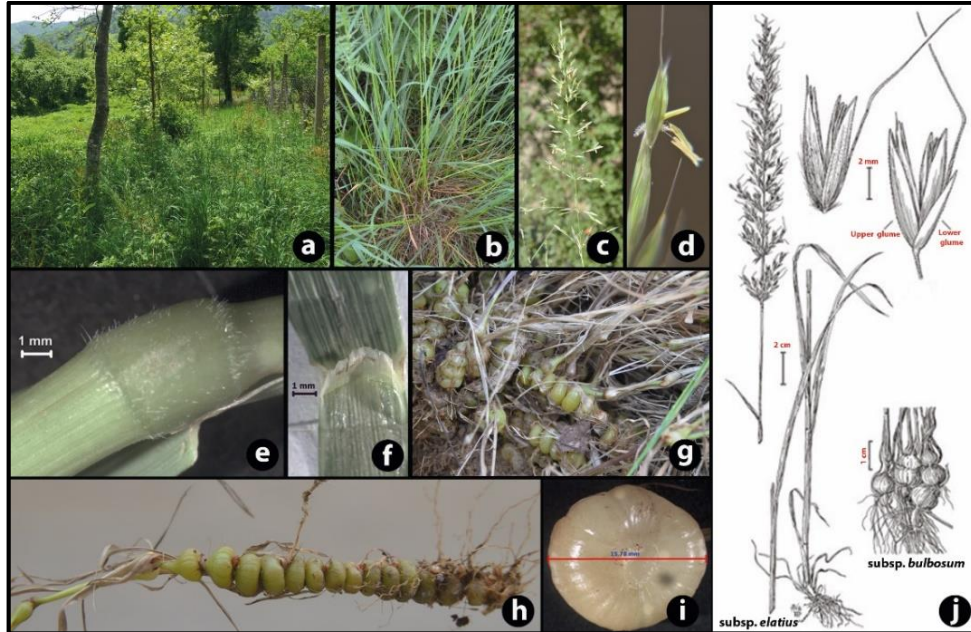


Figure 1. *Arrhenatherum elatius* subsp. *bulbosum*: **a**-Habitat in tea and hazelnut plantations, **b**-Many culms in a clump, **c**-Panicle, **d**- Ovary and stamens, **e**- Portion of culm and hairy node, **f**- Portion of sheath, **g**, **h**- Adjacent base nodes; swollen and form a chain of bulbs, **i** – Globose basal internode, 15.78 mm in diameter, **j**- Line drawings of two subspecies (adapted from Hatch, 2007).

The future studies focus on the evaluation of the social, environmental and economic sustainability of hazelnut cultivation are recommended by Bozoğlu et al. (2019) and, it is reported that uncontrolled weed growth can cause a loss of yield productivity to the extent of 50-70 per cent in the tea cultivations (Deka and Barua, 2015). Therefore, it is inevitable to control the such kind of IAS in the agricultural areas.

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Statement of Conflict of Interest

Author has declared no conflict of interest.

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